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## **Sound velocity measurement of $\text{La}_{2-2x}\text{Sr}_{1+2x}\text{Mn}_2\text{O}_7$ single crystals**

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We have grown  $\text{La}_{2-2x}\text{Sr}_{1+2x}\text{Mn}_2\text{O}_7$  ( $x=0.35, 0.40$ ) single crystals by the floating-zone (FZ) method. We have performed magnetization, electric resistivity and sound velocity measurements in order to study on magnetic spin fluctuations due to the 2 dimensional Mn-O layered structure, which is considered to bring about its large CMR effect. In all elastic constants determined by the ultrasonic measurement, softening have been observed upward  $T_c$ , and hardening just below  $T_c$ . We suppose the obtained softening are ascribed to the magnetic distortions. Moreover, softening upward  $T_c$  of  $c_{33}$  elastic constant in  $x=0.35$  is bigger than that in  $x=0.40$ . It implies that in  $d\gamma$  electron orbits, the occupation rate of  $d(3z^2 - r^2)$  state in  $x=0.35$  is larger than that of  $d(x^2 - y^2)$  state. Our results suggest that the occupation rate of  $d(3z^2 - r^2)$  and  $d(x^2 - y^2)$ , and also the energy splitting between them depends on the concentration  $x$ .